



Protocols for Calculating the Diatom Total Phosphorus Index (DTPI) and Diatom Total Nitrogen Index (DTNI) for Wadeable Streams and Rivers



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Standard Operating Procedure

- 1. Applicability.** The models are applicable to benthic diatom samples collected from rocks or logs in streams and river segments with open to partly open canopy and less than 1 meter in depth.
- 2. Purpose.** This standard operating procedure describes two multiple regression models, the Diatom Total Phosphorus Index (DTPI) and Diatom Total Nitrogen Index (DTNI), that use benthic diatom community data to estimate concentrations of total phosphorus (TP) and total nitrogen (TN) in Maine streams and rivers. The DTPI and DTNI will be used to help determine attainment of water quality standards. The models will also be used to track water quality over time in response to increased pollution or restoration activities.

3. Definitions

- A. Benthic Algae.** Algae growing on substrates on the stream bottom.
- B. Diatom.** Algae in the class Bacillariophyceae.
- C. Inference Model.** A statistical tool that uses species composition data collected from a waterbody to estimate the value of an environmental variable in the waterbody, such as pH or nutrient concentrations.
- D. Regression Model.** A statistical model that uses one or more variables as input to predict the likely value for a dependent variable.

4. Responsibilities

- A. Data Collection and Submission.** Algae must be collected by qualified personnel following Maine Department of Environmental Protection's (DEP) standard operating procedures (Danielson 2006) or comparable method. Algal samples must be processed and diatoms must be identified and enumerated following the protocols set forth the North American Water Quality Assessment (NAWQA) program of the U.S. Geological Survey (Charles et al. 2002) or comparable method. Data must be submitted in Electronic Data Deliverable (EDD) format for uploading into the Environmental Geographic Analysis Database (EGAD).

B. Model Calculations. Data must be checked for quality assurance purposes by qualified DEP staff. Data can then be loaded into EGAD to run the model calculations.

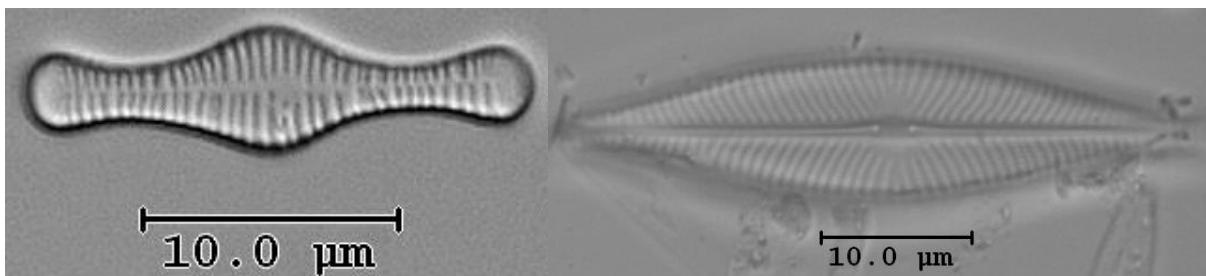
5. Guidelines and Procedures

A. Introduction. Diatoms are commonly used to measure the impacts of nutrient enrichment on water quality. The availability of nutrients is one of the key factors determining which diatoms can survive in a stream. Some diatoms are usually only collected in low-nutrient streams, some are restricted to high-nutrient streams, and others have broad nutrient preferences. *Tabellaria flocculosa* is an example of a species that is most common in low nutrient streams and decreases in abundance with nutrient enrichment (Figure 1). In contrast, *Navicula trivialis* is an example of a high-nutrient diatom that increases in abundance with nutrient enrichment (Figure 1).

Diatom communities are better indicators of nutrient enrichment than water samples. Water samples can provide incomplete estimates of nutrient enrichment because they represent discrete moments in time. Nutrient concentrations, especially of phosphorus, can fluctuate in developed watersheds because of increased non-point source pollution and stream bank erosion following rain storms. Several water samples may not effectively represent the cumulative supply of nutrients over time because of the variation in concentrations. In contrast, diatom communities develop and are exposed to nutrients over a period of weeks or months. The cumulative supply of nutrients can influence which species can survive and can shape the overall community structure.

Nutrient inference models estimate nutrient concentrations in a stream by using diatom abundances and their nutrient preferences. They are based on overall patterns in species composition. A diatom sample consisting of mostly low-nutrient diatoms will have a low estimated nutrient concentration. In contrast, a diatom sample consisting of mostly high-nutrient diatoms will have a high estimated nutrient concentration.

Figure 1. *Tabellaria flocculosa* (left) and *Navicula trivialis* (right).



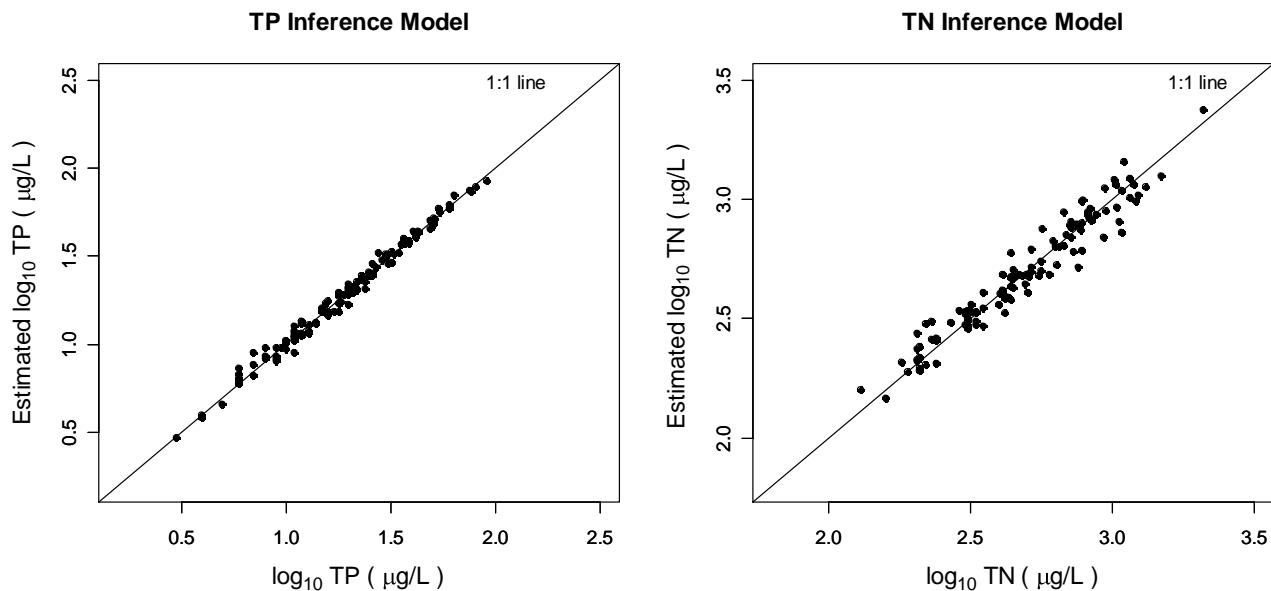
B. Model Development. The models were developed by assembling 123 samples from streams across the state. The streams ranged from low-nutrient streams to high-nutrient streams. Data included TN and TP concentrations from stream water and diatoms collected by scraping rocks in the streams. A variety of statistical models were tested and a multiple linear regression approach was ultimately selected because of its performance

and ease of calculation. Linear regression uses a simple formula to describe a straight-line relationship between two variables: $Y = \beta x + \beta_0$. Y is the dependent or response variable that is predicted, x is the independent or explanatory variable, β is the coefficient for the explanatory variable, and β_0 is the constant. Multiple regression follows the same approach but uses more than one explanatory variable.

The DTPI and DTNI are regression models that use many species as independent variables in the calculations. A statistical technique called forward stepwise selection was used to identify the combination of species that provide the best estimate of the observed TP and TN concentrations. The statistical application took the diatom and nutrient data and iteratively added species and assigned the species coefficients (i.e., β). It selected the combination of species and their coefficients that best predicted the nutrient concentrations in a straight line with the least amount of scatter around the line.

Two measurements were used to measure how well the models fit a straight line. The r^2 value measures the strength of the association and the root mean square error (RMSE) measures the amount of scatter around the line. A perfect relationship would have an r^2 of 1 and a RMSE of 0. The worst relationship would have a r^2 of 0 and a very high RMSE. The adjusted r^2 and RMSE of the TP model were 0.90 and 0.10 respectively (Figure 2). The adjusted r^2 and RMSE of the TN model were 0.91 and 0.07 respectively. Both models were tested with another set of 75 samples. Overall, the performance of the Maine models is comparable to nutrient inference models developed for New Jersey (Ponader et al. 2007, Ponader et al. 2008), the Northern Piedmont Region of the U.S. (Potapova et al. 2004), and western U.S. (Stevenson et al. 2008).

Figure 2: TP and TN inference models for Maine streams and rivers.



C. Data Preparation

- 1) **Exclude Rare Species.** Rare species can reduce the predictive quality of inference models because calculating their nutrient preferences is difficult. The models were built using a subset of 209 of the most common diatom species (Table 1). New calculations need to be based on the same subset of 209 diatoms to be consistent with the way the models were developed. Including rare species would change the percent abundances of the common taxa. Therefore, any taxa that are present in a sample but are not included in Table 1, are excluded.
- 2) **Calculate Square Root of Percent Abundances.** Once species not included in Table 1 are removed, the next step is to convert the species counts to percent abundances. Diatom abundances are based on the density of cells per square centimeter of substrate sampled.
 - i. Divide the abundance of each species in a sample by the total abundance of all species in the sample that are listed in Table 1.
 - ii. The next step is to calculate the square root of the abundances. The models use the square roots of percent abundances to reduce the influence of a few ubiquitous and abundant diatoms such as *Achnanthidium minutissimum*.

D. Diatom Total Phosphorus Index (DTPI)

- 1) **Exclude Taxa without TP Coefficients.** Only include those species with TP coefficients when calculating the DTPI (Table 1).
- 2) **Model Formula.** $TP^* = 1.322585 + \sum_i x_i \beta_i^{TP}$
 - i. TP^* is the \log_{10} TP ($\mu\text{g/L}$)
 - ii. Σ is the symbol for summation.
 - iii. x_i is the square root percent abundance of species i
 - iv. β_i^{TP} is the TP coefficient of species i in Table 1
- 3) **Applicable Range.** Index values outside of the ranges specified below must be treated with caution since they are beyond the scope of the original models. In addition, extreme values can be caused by atypical diatom communities. The applicable range for TP^* is between 0.4 and 2.1.
- 4) **Convert Results.** The final step is to convert TP^* from \log_{10} units to normal units. This is accomplished by using the following formula:

$$DTPI = \text{Estimated TP } (\mu\text{g/L}) = 10^{TP^*}$$

E. Diatom Total Nitrogen Index (DTNI)

- 1) **Exclude Taxa Without TN Coefficients.** Only include those species with TN coefficients when calculating the DTNI (Table 1).
- 2) **Model Formula.** $TN^* = 2.245248 + \sum_i x_i \beta_i^{TN}$
 - i. TN^* is the \log_{10} TN ($\mu\text{g/L}$)
 - ii. Σ is the symbol for summation.
 - iii. x_i is the square root percent abundance of species i
 - iv. β_i^{TN} is the TN coefficient of species i in Table 1
- 3) **Applicable Range.** Index values outside of the ranges specified below must be treated with caution since they are beyond the scope of the original models. In addition, extreme values can be caused by atypical diatom communities. The applicable range of TN^* is between 2.1 and 3.4.
- 4) **Convert Results.** The final step is to convert TN^* from \log_{10} units to normal units. This is accomplished by using the following formula:

$$DTNI = \text{Estimated TN } (\mu\text{g/L}) = 10^{TN^*}$$

Table 1 – List of 209 diatom species (and their DEP taxonomic codes) to be used in calculating square root percent abundances and the TP and TN coefficients used to calculate the DTPI and DTNI.

Species	Code	TN Coef.	TP Coef.
<i>Achnanthes nollii</i> Bock	ACnollii		
<i>Achnanthes oblongella</i> Østrup	ACoblong	0.173293	0.142281
<i>Achnanthes subhudsonis</i> var. <i>kraeuselii</i> (Cholnoky) Cholnoky	ACsubkra		
<i>Achnanthidium deflexum</i> (Rabenhorst) Lange-Bertalot et Ruppel	ADdeflex	0.040581	
<i>Achnanthidium exiguum</i> (Grunow) Czarnecki	ADexigua		
<i>Achnanthidium minutissimum</i> (Kützing) Czarnecki	ADminuti	0.018376	-0.028851
<i>Achnanthidium rivulare</i> Potapova et Ponader	ADrivula	0.050075	
<i>Adlafia bryophila</i> (Petersen) Lange-Bertalot	ALbryphl		-0.07318
<i>Amphipleura pellucida</i> (Kützing) Kützing	APpelluc		-0.167188
<i>Amphora pediculus</i> (Kützing) Grunow	AMpedcls	0.110615	
<i>Asterionella formosa</i> Hassal	ASformos		
<i>Aulacoseira alpigena</i> (Grunow) Krammer	AUalpige		
<i>Aulacoseira ambigua</i> (Grunow) Simonsen	AUambigu		0.14403
<i>Aulacoseira granulata</i> (Ehrenberg) Simonsen	AUgranal		
<i>Brachysira brebissonii</i> Ross	BRbrebis		
<i>Brachysira microcephala</i> (Grunow) Compère	BRmicroc		
<i>Brachysira vitrea</i> (Grunow) Ross	BRvitrea		
<i>Caloneis bacillum</i> (Grunow) Cleve	CAbacill	0.275167	
<i>Cavinula cocconeiformis</i> (Gregory ex Greville) Mann et Stickle	CJcoccon		
<i>Chamaepinnularia bremensis</i> (Hustedt) Lange-Bertalot	CKbremen		
<i>Chamaepinnularia mediocris</i> (Krasske) Lange-Bertalot	CKmedioc		
<i>Coccneis pediculus</i> Ehrenberg	CCpedcls		0.097392
<i>Coccneis placentula</i> var. <i>euglypta</i> (Ehrenberg) Grunow	CCplaeug	-0.043675	
<i>Coccneis placentula</i> var. <i>lineata</i> (Ehrenberg) Van Heurck	CCplalin		
<i>Craticula submolesta</i> (Hustedt) Lange-Bertalot	CRsubmol	-0.063395	
<i>Ctenophora pulchella</i> (Ralfs ex Kützing) Williams et Round	CTpulche		
<i>Cyclotella meneghiniana</i> Kützing	CYmenegh		
<i>Cyclotella michiganiana</i> Skvortzow	CYmichig		
<i>Cymbella affinis</i> Kützing	CMaffins	-0.122131	
<i>Cymbella cistula</i> (Ehrenberg) Kirchner	CMcistul		
<i>Cymbella delicatula</i> Kützing	CMdelcat		-0.076764
<i>Cymbella gracilis</i> (Ehrenberg) Kützing	CMgracil	0.082538	
<i>Cymbella naviculiformis</i> Auerswald ex Héribaud	CMnavicu		0.200185
<i>Cymbella tumida</i> (Brébisson ex Kützing) Van Heurck	CMtumida		
<i>Diatoma mesodon</i> (Ehrenberg) Kützing	DAmesodo		
<i>Diatoma moniliformis</i> Kützing	Damonili		
<i>Diatoma tenuis</i> Agardh	DAtenuis		
<i>Discostella pseudostelligera</i> (Hustedt) Houk et Klee	DOpseudo	-0.24269	

Species	Code	TN Coef.	TP Coef.
<i>Discostella stelligera</i> (Hustedt) Houk et Klee	DOstelli		
<i>Encyonema minutum</i> (Hilse) Mann	ENminutu		
<i>Encyonema prostratum</i> (Berkeley) Kützing	ENprostr		
<i>Encyonema reichardtii</i> (Krammer) Mann	ENreicha		
<i>Encyonema silesiacum</i> (Bleisch) Mann	ENSilesi		
<i>Encyonopsis cesatii</i> (Rabenhorst) Krammer	EScesati		
<i>Encyonopsis microcephala</i> (Grunow) Krammer	ESmicroc		-0.155503
<i>Eucocconeis laevis</i> (Østrup) Lange-Bertalot	EClaevis	-0.083052	
<i>Eunotia arcus</i> var. <i>bidens</i> Grunow	EUarcbid		
<i>Eunotia bilunaris</i> (Ehrenberg) Mills	EUBiluna		
<i>Eunotia exigua</i> (Brébisson ex Kützing) Rabenhorst	EUexigua	0.066465	
<i>Eunotia flexuosa</i> Brébisson ex Kützing	EUflexuo		
<i>Eunotia implicata</i> Nörpel, Lange-Bertalot et Alles	EUimplic		
<i>Eunotia incisa</i> Smith ex Gregory	EUincisa		
<i>Eunotia minor</i> (Kützing) Grunow	EUminor		
<i>Eunotia muscicola</i> var. <i>tridentula</i> Nörpel et Lange-Bertalot	EUmustri	-0.509509	-0.415916
<i>Eunotia naegelii</i> Migula	EUnaegel	0.120606	
<i>Eunotia paludosa</i> Grunow	EUpaludo	-0.133429	-0.327318
<i>Eunotia pectinalis</i> (Müller) Rabenhorst	EUpectin		
<i>Eunotia pectinalis</i> var. <i>undulata</i> (Ralfs) Rabenhorst	EUpecund		-0.053001
<i>Eunotia praerupta</i> Ehrenberg	EUPraeru		
<i>Eunotia rhomboidea</i> Hustedt	EUrhombo		
<i>Eunotia soleirolii</i> (Kützing) Rabenhorst	EUsoleir		
<i>Eunotia subarcuatoides</i> Alles, Nörpel et Lange-Bertalot	EUsubarc		
<i>Fragilaria capucina</i> Desmazières	FRcapuci		
<i>Fragilaria capucina</i> var. <i>gracilis</i> (Østrup) Hustedt	FRcapgra		0.02382
<i>Fragilaria sepes</i> Ehrenberg	FRsepes	0.046787	
<i>Fragilaria tenera</i> (Smith) Lange-Bertalot	FRtenera		
<i>Fragilaria vaucheriae</i> (Kützing) Petersen	FRvauche		
<i>Fragilaria vaucheriae</i> var. <i>capitellata</i> (Grunow) Ross	FRvaucap	0.091822	
<i>Fragilariforma virescens</i> (Ralfs) Williams et Round	FAviresc		
<i>Frustulia amphipleuroides</i> (Grunow) Cleve-Euler	FSamphip		
<i>Frustulia crassinervia</i> (Brébisson) Lange-Bertalot et Krammer	FScrassi		
<i>Frustulia krammeri</i> Lange-Bertalot et Metzeltin	FSkramme	0.079925	
<i>Frustulia vulgaris</i> (Thwaites) deToni	FSvulgar		
<i>Geissleria decussis</i> (Hustedt) Lange-Bertalot et Metzeltin	GAdecuss	-0.092402	
<i>Gomphonema acuminatum</i> Ehrenberg	GOacumin		
<i>Gomphonema affine</i> Kützing	GOaffine		
<i>Gomphonema angustatum</i> (Kützing) Rabenhorst	GOangust	0.08028	
<i>Gomphonema angustum</i> Agardh	GOangstm		
<i>Gomphonema drutelingense</i> Reichardt	GOdrutel		-0.112772
<i>Gomphonema gracile</i> Ehrenberg emend Van Heurck	GOgracil		

Species	Code	TN Coef.	TP Coef.
<i>Gomphonema kobayasi</i> Kociolek et Kingston	GOkobaya	0.107094	
<i>Gomphonema micropus</i> Kützing	GOmicrop		
<i>Gomphonema minutum</i> (Agardh) Agardh	GOminutu	0.057565	
<i>Gomphonema olivaceoides</i> Hustedt	GOolivco		
<i>Gomphonema parvulum</i> (Kützing) Kützing	GOparvul		0.035445
<i>Gomphonema patrickii</i> Kociolek et Stoermer	GOpatric		
<i>Gomphonema pumilum</i> (Grunow) Reichardt et Lange-Bertalot	GOPumilu		
<i>Gomphonema pumilum</i> var. <i>rigidum</i> Reichardt et Lange-Bertalot	GOPumilu		
<i>Gomphonema rhombicum</i> Fricke	GORhombi		
<i>Gomphonema</i> spp.	GO		
<i>Gomphonema truncatum</i> Ehrenberg	GOtrunca		0.073149
<i>Hippodonta capitata</i> (Ehrenberg) Lange-Bertalot, Metzeltin et Witkowski	HPcapita		0.12347
<i>Karayevia clevei</i> (Grunow) Bukhtiyarova	KAClevei		
<i>Karayevia laterostrata</i> (Hantzsch) Bukhtiyarova	KALatero		
<i>Karayevia suchlandtii</i> (Hustedt) Bukhtiyarova	KASuchla		0.268543
<i>Luticola mutica</i> (Kützing) Mann	LUmutica		
<i>Mayamaea agrestis</i> (Hustedt) Lange-Bertalot	MYAgrest		
<i>Mayamaea atomus</i> var. <i>permisis</i> (Hustedt) Lange-Bertalot	MYatoper		
<i>Melosira varians</i> Agardh	MEvarian		
<i>Meridion circulare</i> (Greville) Agardh	MDcircul		
<i>Meridion circulare</i> var. <i>constrictum</i> (Ralfs) Van Heurck	MDcircon		
<i>Navicula angusta</i> Grunow	NAangust		
<i>Navicula antonii</i> Lange-Bertalot	NAanton		
<i>Navicula capitoradiata</i> Germain	NACaprad	0.07829	
<i>Navicula cryptocephala</i> Kützing	NACrypto	0.107229	0.176553
<i>Navicula cryptotenella</i> Lange-Bertalot ex Krammer et Lange-Bertalot	NACryten	-0.047946	
<i>Navicula cryptotenelloides</i> Lange-Bertalot	NACrytot		0.092992
<i>Navicula gregaria</i> Donkin	NAGregar		
<i>Navicula lanceolata</i> (Agardh) Ehrenberg	NALanceo		
<i>Navicula leptostriata</i> Jörgansen	NAleptos		
<i>Navicula menisculus</i> Schumann	NAmenscl		
<i>Navicula minima</i> Grunow	NAMinima		
<i>Navicula notha</i> Wallace	NAnotha	-0.070592	
<i>Navicula radios</i> Kützing	NAradios		
<i>Navicula radiosafallax</i> Lange-Bertalot	NAradiof		
<i>Navicula rhynchocephala</i> Kützing	NArhynch		
<i>Navicula rostellata</i> Kützing	NArostel		
<i>Navicula schmassmanni</i> Hustedt	NAschmas		-0.24594
<i>Navicula schoeteri</i> var. <i>escambia</i> Patrick	NAschroe		
<i>Navicula tripunctata</i> (Müller) Bory	NAtipun		

Species	Code	TN Coef.	TP Coef.
<i>Navicula trivalis</i> Lange-Bertalot	NAtrivia		0.170725
<i>Navicula veneta</i> Kützing	NAveneta		
<i>Navicula viridula</i> (Kützing) Kützing emend. Van Heurck	NAviridu		
<i>Navicula viridulacalcis</i> (Hustedt) Lange-Bertalot	NAvirlin		
<i>Nitzschia acidoclinata</i> Lange-Bertalot	Nlacidoc	0.120971	
<i>Nitzschia amphibia</i> Grunow	Nlamphib	-0.088765	
<i>Nitzschia capitellata</i> Hustedt	Nlcapite		
<i>Nitzschia dissipata</i> (Kützing) Grunow	Nldissip		
<i>Nitzschia dissipata</i> var. <i>media</i> (Hantzsch) Grunow	Nldismed		
<i>Nitzschia fonticola</i> Grunow	Nlfontic		
<i>Nitzschia frustulum</i> (Kützing) Grunow	Nlfrustu		
<i>Nitzschia gracilis</i> Hantzsch ex Rabenhorst	Nlgracil		
<i>Nitzschia inconspicua</i> Grunow	Nlincons		0.144145
<i>Nitzschia liebethruthii</i> Rabenhorst	Nliebtrt		
<i>Nitzschia linearis</i> (Agardh ex Wm. Smith) Wm. Smith	Nlinear		
<i>Nitzschia palea</i> (Kützing) Smith	Nlpalea		0.055
<i>Nitzschia paleacea</i> Grunow ex Van Heurck	Npaleac	0.164201	
<i>Nitzschia perminuta</i> (Grunow) Peragallo	Npermin		
<i>Nitzschia pumila</i> Hustedt	Npumila		
<i>Nitzschia recta</i> Hantzsch ex Rabenhorst	Nrecta		
<i>Nitzschia supralitorea</i> Lange-Bertalot	Nsupral		
<i>Nitzschia tubicola</i> Grunow ex Cleve et Grunow	Ntubico		
<i>Pinnularia gibba</i> Ehrenberg	Plgibba		
<i>Pinnularia obscura</i> Krasske	Plobscur		
<i>Pinnularia subcapitata</i> Gregory	Plsubcap		
<i>Pinnularia viridis</i> (Nitzsch) Ehrenberg	Plviridi		
<i>Planothidium frequentissimum</i> (Lange-Bertalot) Lange-Bertalot	PLfreque	0.115348	
<i>Planothidium lanceolatum</i> (Brébisson ex Kützing) Lange-Bertalot	PLLanceo		
<i>Planothidium lanceolatum</i> var. <i>omissum</i> (Reimer) Andresen, Stoermer et Kreis	PLLanceo		
<i>Planothidium rostratum</i> (Østrup) Lange-Bertalot	PLrostra		
<i>Planothidium stewartii</i> (Patrick) Lange-Bertalot	PLstewar		0.572415
<i>Platessa conspicua</i> (Mayer) Lange-Bertalot	PVconspi		
<i>Psammothidium bioretii</i> (Germain) Bukhtiyarova et Round	PSbioret		-0.123658
<i>Psammothidium chlidanos</i> (Hohn et Hellerman) Lange-Bertalot	PSchlida		
<i>Psammothidium grischunum</i> fo. <i>daonensis</i> (Lange-Bertalot ex Lange-Bertalot et Krammer) Bukhtiyarova et Round	PSgridao		
<i>Psammothidium helveticum</i> (Hustedt) Bukhtiyarova et Round	PShelvet		
<i>Psammothidium marginulatum</i> (Grunow) Bukhtiyarova et Round	PSmargin		
<i>Psammothidium subatomoides</i> (Hustedt) Bukhtiyarova et Round	PSsubato	0.07577	
<i>Psammothidium ventralis</i> (Krasske) Bukhtiyarova et Round	PSventra		
<i>Pseudostaurosira brevistriata</i> (Grunow) Williams et Round Round	PTbrevis	-0.131968	

Species	Code	TN Coef.	TP Coef.
<i>Reimeria sinuata</i> (Gregory) Kociolek et Stoermer	REsinuat		
<i>Rhoicosphenia abbreviata</i> (Agardh) Lange-Bertalot	ROabbrev	0.027763	
<i>Rossithidium linearis</i> (Smith) Round et Bukhtiyarova	RMlinear		
<i>Sellaphora pupula</i> (Kützing) Meresckowsky	SEpupula		
<i>Sellaphora seminulum</i> (Grunow) Mann	SEseminu		
<i>Stauroforma exiguiformis</i> (Lange-Bertalot) Flower, Jones et Round	SQexigui		
<i>Stauroneis anceps</i> Ehrenberg	SSanceps		
<i>Stauroneis kriegeri</i> Patrick	SSkriege		
<i>Staurosira construens</i> Ehrenberg	STconstr		
<i>Staurosira construens</i> var. <i>venter</i> (Ehrenberg) Hamilton	STconsve		
<i>Staurosira elliptica</i> (Schumann) Williams et Round	STellipt		-0.194351
<i>Staurosirella pinnata</i> (Ehrenberg) Williams et Round	SLpinnat	0.099565	
<i>Surirella amphioxys</i> Smith	SUamphio	0.095076	
<i>Surirella angusta</i> Kützing	SUangust		
<i>Surirella minuta</i> Brébisson	SUminuta		
<i>Synedra acus</i> Kützing	SYacus		
<i>Synedra rumpens</i> Kützing	SYrumpen	0.019816	
<i>Synedra ulna</i> (Nitzsch) Ehrenberg	SYulna		
<i>Synedra ulna</i> var. <i>oxyrhynchus</i> (Kützing) Van Heurck	SYulnoxy		
<i>Tabellaria flocculosa</i> (Roth) Kützing	TAfloccu		-0.039732

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